

DISASTER MANAGEMENT IN HIGH RISK REGIONS: A CASE STUDY ON THE INDIAN HIMALAYAS REGION

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Abstract

The occurrence of several cases of natural disaster and its impact on high-risk regions remains an issue that continues to attract continued research, most especially from a global perspective. Despite the devastating impact of several known natural phenomenon such as flooding, Tsunami's, earthquakes, glaciers and Tornadoes, there seem not to be well-structured disaster management approach from stakeholders in high-risk disaster-prone regions to cope with eventual disaster cases. The Indian Himalayan region under review within this research paper has been conducted investigated, and a review on how the build of poorly constructed residential have impacted the lives of people living within this region. This paper addresses this problem in a line with well-structured thematic sections that examines community resilience, effective stakeholder communication and community preparedness can result in effective disaster management approach.

Keywords: Disaster, Climate Change, Disaster Management, Poorly-Constructed Residential Buildings, Community resilience, Indian Himalayas.

INTRODUCTION

The concepts of sustainable development and resilience are sometimes used interchangeably (*Farsi et al.* 2017; Hosseinian-Far & Jahankhani, 2015), and have routes in disaster management as a subject area. The concept of resilience refers to the ability of a system to sustain its operation when affected by external forces. The same concept applies within the context of resilience to disasters. After the disastrous Tsunami that hit the Indian Ocean region in December 2004 (*Suppasri et al.* 2015), there has been an increased sensitization in recent years on the likely damaging impacts of tsunamis (Older, 2015) and several life-threatening natural events (*Stephan et al.* 2017). Communities along the coastal lines are the most vulnerable to naturally induced disaster situations (*Mallick et al.* 2017) partly due to climate change (*Aliagha et al.* 2015) and some unnatural causes resulting from human activities on their environment (Noy, 2015). However, research in the area of disaster management is becoming intensified, as global development agencies are focused on formulating relief frameworks and actions (Managi and Guan, 2017) to prevent the adverse impact of natural disasters (*Witvorapong et al.* 2015).

Intriguingly, over the past decade, there have been a rise in the number of natural disasters across the world (*Cassar et al.* 2017). Figures released by the Emergency Events Database (EM-DAT) in 2018 indicates a 62.9% increase in global disaster rates, with death tolls margin around 84.3% (*Auzzir et al.* 2018) resulting to economic damage of about 120% in the same year (Lahai and Lahai, 2019). An average of 32.3 million people around the world was displaced by disasters associated with weather or climate changes (Hossain, 2015).

Statistics from 2012 showed that the global disaster levels rose by approximately 2.4% against the preceding year (*Jeppesen et al.* 2015), this was majorly attributed to weather-related events (*Kelman et al.* 2016). The mortality index ratio for people residing in high-risk disaster-prone

regions has also increased in recent times (*Wong et al. 2016*). Finding between the late '80s and a decade of a millennium confirms that in Canada, there was at least 41.9% known incidents of floods and 31.8% resulting from wildfire (*Townshend et al. 2015*). However, incorporating a modern approach to managing disaster and its after effect poses a huge concern to stakeholders across the world (*Ferraro and George, 2016*). The adverse impact of global warming and climate change (*Johnson et al. 2018*) on the ecosystem further stresses the demand for the adoption of preventive measures to alleviate future catastrophes (*Cutter et al. 2013*; *Shao, 2016*; *Hosseini-Far et al. 2011*; *Hosseini-Far et al. 2010*).

Over the years, several natural events have resulted in individuals and communities being exposed and prone to disaster situations (*Alfred et al. 2015*; *Ostadtaghizadeh et al. 2016*; *Linnenluecke and McKnight, 2017*). This level of vulnerability which has been widely researched area examines the extent of susceptibility of a defined group, society or community (*Bergstrand et al. 2015*; *Gil-Rivas and Kilmer, 2016*) to natural disasters (*Maikhuri et al. 2017*; *Kang and Skidmore, 2018*) and accessing their response framework (*Himes-Cornell et al. 2018*; *Serfilippi and Ramnath, 2018*).

It is believed that decades of social ideals and routine practices (*Cretney, 2016*; *Rogers et al. 2016*) have played significant roles in helping communities cope with their vulnerability to known devastating natural catastrophes (*Manning et al. 2015*; *Weichselgartner and Kelman, 2015*; *Kelman et al. 2016*). This further establishes the fact that in order to survive (*Misanya and Øyhus, 2015*; *Landry et al. 2016*), it is imperative that residents in hazard-prone communities unite (*Baytiyeh, 2017*; *Ramos-Castillo et al. 2017*) as multiple factors such as marginalization (*McKinnon et al. 2016*) and inadequate access to resources (*Deen, 2015*; *Dumenu and Obeng, 2016*) as an individualistic approach could prove insufficient (*Lowe et al. 2015*; *Tint et al. 2015*).

In recent times, there have been increased global concerns over the Himalayan region which has often been hit by series of natural and anthropogenic calamities (*Malik et al. 2016*; *Agnihotri et al. 2017*; *Haq et al. 2019*) thereby making it one of the most disaster-prone regions in this modern era (*Elalem and Pal, 2015*; *Shrestha et al. 2015*; *Stanley and Kirschbaum, 2017*). Also, the influence of global warming within the Himalayas has impacted negatively on the region (*Li et al. 2016*; *Sigdel et al. 2018*) resulting in glacial retreats and unpredictable seasons (*Gao et al. 2016*; *Kattel et al. 2017*; *You et al. 2017*). Understanding the interconnectivity between people and their natural environment has remained a much-explored topic of intensive academic and practical research discussion for many decades (*Oken et al. 2015*). The conceptualisation of this interaction gives a clear insight into the perceived affinity people have regarding their environment. However, this supposed relationship between humans and their environment could be impacted by notable change such as rise in sea levels, wetland loss, desertification (*Silver and Grek-Martin, 2015*).

Above and beyond the recurrent reports of forest fires and environmental degradation that has characterised the Himalayan regions (*Bali et al. 2017*), subjective disaster cases of massive flash flooding in 2013 which wrecked the Kedarnath valley of Uttarakhand (*Shekhar et al. 2015*). This led to the devastating loss of life and property, one that was documented as the biggest disaster in the history of the Indian Himalayan region (*Mehta et al. 2016*). Although, previous research around the region have revealed that 90% of the disasters recorded in the Indian Himalayan region were mainly due to the poor residential building constructions on the mountainous region (*Chandel et al. 2016*). Rural settlers especially those within the mountain

seismic zones located around the Rudraprayag districts have been defenceless against the high risk of landfalls due to heavy rainfall (Sahana and Sajjad, 2017).

Emphasis has been on the poor level of construction for residential buildings around the Indian Himalayan region poses a major risk to human life, considering the area is also characterized by first-degree earthquakes. An investigation on the region shows that the houses within the region are constructed with materials which could not stand during disaster situations. Hence, it is however important to take into perspective the quality and standard of residential building construction projects within the region and how it impacts human life during an eventual disaster situation.

This paper attempts to investigate the effect for poorly constructed residential buildings within the constructs of disaster management and how it impacts human lives: A case study on the Indian Himalayan region. The objective of this research work is to address the topic through the following approaches:

- Exploring the impact of a disaster on poorly constructed residential buildings in the Indian Himalayan region.
- Examining what disaster management approaches are currently being adopted to assist residents living within the region.
- Carrying out a comparative study to ascertain what measures are used by developed-world nations to reduce the impact of a disaster on residential buildings in parity to those of developing countries.

This piece of research will proceed to discuss these key issues in a well sectioned and thematic format in line with relevant academic research. A session on the literature review around disaster and disaster management will be utilised to provide useful analogy around the topic. Subsequent sessions will examine associated impacts of poorly constructed residential buildings and how it impacts the well-being of those living within the Indian Himalayan region. The following session will present a comparative study on developed and under-developed world nations in dealing with residential building construction. A final session will review what policies are currently been adopted to prevent the incessant erection of substandard residential buildings within the region. A conclusion will be drawn based on the findings from the narratives developed from the research paper.

LITERATURE REVIEW

Disaster may be referred to as a natural occurrence which directly or indirectly subjects a community of people to incur losses to property and in more volatile cases loss of life (*Ostadtaghizadeh et al.* 2016). Besides known natural causes, disaster could occur from several associated factors ranging from environmental, social-economical and in most instances political (Levy and Patz, 2015; Randle and Eckersley, 2015, *Whittaker et al.* 2015). Although there exists no consensus definition to disaster but a generally accepted illustration to disaster events was put forward by the International Strategy for Disaster Reduction (ISRD) referred to disaster as a state of adverse interruption to the operations of a society or group resulting to an extensive anthropological, physical and financial damage that are beyond the resources of the society to cope with such events (Bier, 2017; *Auzzir et al.* 2018; Mechler and Bouwer, 2015). Kelman (2018) on the other hand views disaster from a social construct, where the probability for a potential hazard rests on the dynamic interaction between people and their immediate environment.

Contrary definitions by Jon (2019) and Wilkin (2019) view disaster an event that exposes communities to harm with limited or no means to survive the event. Disasters may also be defined as a sequence of unpredictable and calamitous events (Keerthiratne and Tol, 2018) that are widely linked to variations in climatic conditions (*Townshend et al.* 2015). Weichselgartner and Kelman (2015) further suggest that a society can experience certain levels of harm and loss without there necessarily been a disaster for the society itself.

From a social standpoint, Dodds (2015) saw disaster to be creations of a precise age and political philosophies that tend to evolve with time. The increase in the occurrence of disaster has evidenced the need to develop suitable recovery mechanisms (Rautela, 2016) to reduce or alleviate the impact of potential disaster situations has become imperative from a present stance (Matyas and Pelling, 2015). There have been different assertions on the impact of catastrophes across the globe over the past decades (*Coetzee et al.* 2016). Therefore, understanding the concept of disaster management provides insight into possible ways to averse identified natural or human-caused danger (Cretney, 2016). Some definitions of disaster management put forward by most scholars would throw more light on the context of disaster management.

Disaster management can be defined as an array of targeted actions aimed at controlling disaster and emergencies (*Dahlberg et al.* 2015). Lam and Kuipers, (2019) went further to describe disaster management as an approach towards delivering a framework that helps people cope with the consequences of a risk event. *Vaidya et al.* (2019) believe that disaster management involves a systematic method of identifying and analysing a particular risk event over a period to take improved measures to guard or prepare for a potential future occurrence. A contemporary approach to the definition of disaster management argues that it is not an act of response to extreme risk situations (Nappi and Souza, 2015) but rather a means of reducing the overall impact of a potential risk that matters (Kato and Charoenrat, 2018).

Managing disasters in high-risk disaster-prone communities require the adoption of a viable resilient framework as a mean of coping with these uncertain natural events (*Townshend et al.* 2015). A typical framework for disaster management includes these three basic components: community resilience; community problem-solving; communicating as a communal unit (*Horita et al.* 2017). *Samaddar et al.* (2015) in their definition of community resilience within the context of disaster management is referred to it as the adaptive capability of a society that is prone to disaster to respond and recover timely from the impact of a major catastrophic event. Aldrich and Meyer, (2015) on the contrary, thinks of community resilience as the process by which a community deals with a hazard event and still possesses the ability to function. A community can also be said to be resilient when its members are known to take a shared approach to salvage the impact of disaster (*Aldunce et al.* 2015), including their ability to study their immediate environment to survive (Imperiale and Vanclay, 2016). However, it is argued that obtaining the level of a community's resilient approach to disaster may be hindered (Khalid and Shafiai, 2015), due to the absence of standard conditions that helps in establishing the aptitude of the community to deal with calamity (*Kelman et al.* 2016).

Understanding the benefits of incorporating an effective community communication system in dealing with disaster is important from a communal standpoint. As emphasised by (*Bunker et al.* 2015) communal communication allows for a shared information approach, proactive decision making (Steigenberger, 2016) and measures that contribute in the reduction of loss to human life and property (*Bradley et al.* 2016).

Further studies have contributed to expanding on the existing knowledge provided on the above disaster management components (*Houston et al.* 2015), but here, we noticed that the framework underpins those factors that focus on community resilience (Aldrich and Meyer, 2015) and the ability of communities to cope with disaster situations (*Kelman et al.* 2016). This review has discovered that the processes leading to resilience can be viewed in terms of the ability of a community to deal with disaster effectively and return to its functional state within a short period.

Drawing from the different scholarly meanings to disaster listed above will further help in analysing the disaster situation in the Indian Himalayan regions and how this has shaped the lives of those residing within the region.

IMPACT OF DISASTER IN THE REGION

The Indian Himalayan region has over the past decades been known as one of the most disasters ravaged regions in the world. Consequently, these isolated catastrophes that have hit the region are mainly attributed to both human and natural dynamics (*Mallick et al.* 2017). These range from the impact of climate change as well as the poorly constructed residential buildings that cannot withstand disaster situations (Rumbach and Follingstad, 2019).

A study on the Uttarakhand region of the Indian Himalayas is one of interest, due to the frequent cases of earthquakes within the region (*Maikhuri et al.* 2017). Due to the brittle nature of the region, multi-storey buildings and bungalows constructed here for residential purposes are exposed to the disaster situations (*Sharma et al.* 2016). Surprisingly, the popular residential building construction types noticed within the rocky Indian Himalayan zone were mainly timber made houses, semi-concrete and brick type houses (Rumbach and Follingstad, 2019). Although residents living close to the Himalayan mountains are aware of the dangers of the region (*Maikhuri et al.* 2017), they still move on erect poorly constructed building that is unable to withstand the shock of an earthquake (*Chandel et al.* 2016).

Reports from the early 90's provided evidence on the 6.6 magnitudes Chamoli and Uttarkashi earthquakes that shook the Uttarakhand area of the Indian Himalayas (Noy, 2015). Furthermore, these earthquakes resulted in the collapse of several buildings that could not withstand the tremor with accountable death tolls placed at 100 and 75 people respectively (*Maikhuri et al.* 2017). Although there have been several bans on bio-materials, wood and mud for building construction within the region, residents complain about the high cost of materials for erecting more solid structures (*Landry et al.* 2016).

Based on the above narrative, residents within the Indian Himalayas must seek to adopt the use of high-quality materials such as reinforced concrete in the construction of their residential buildings. The use of reinforced concrete materials allows the building to withstand any form of shock during an earthquake (*Gautam et al.* 2018). Also, effective and continuous community sensitization on the risk of using poor bio-materials must be incorporated as a disaster management approach to avert future occurrence (Silver and Grek-Martin, 2015).

DISASTER MANAGEMENT APPROACHES

Building a resilience approach is fundamental especially with regards to disaster situations. A review of the regions within the Indian Himalayas shows a broad spectrum of unethical practices in dealing with disaster response within the zone (Gall and Cutter, 2015; Rautela, 2016; Sarwar *et al.* 2017). Accessing the economic damage and impact of disaster allows communities to plan and prepare for disaster (Sharifi, 2016).

There have been recent calls on residents in the disaster-prone Indian Himalayas region to become empowered towards building their capacity to recover from catastrophic events (Sharma *et al.* 2016). A comparative study on resilience building in America shows how residents that reside along coastal lines can reduce the impact of a disaster and promptly recover from the aftermath of a hazardous situation (Yoon *et al.* 2016).

A review on the Nepal community in the Himalayan region showed the lack of effective disaster management practice within the area. The lack of planning and preparedness for disaster events have exposed residents in the Nepal region to even more risk (Gautam *et al.* 2018). Routine maintenance to partially affected buildings is not commonly practised by residents in Nepal (Dizhur *et al.* 2016; Sharma *et al.* 2016), which makes this region suffer the highest mortality rates among other zones in the Indian Himalayas region (Landry *et al.* 2016; Rai *et al.* 2016). This situation within the Nepal region gives an indicative outcome of a region that has failed to incorporate community resilience framework (Aldrich and Meyer, 2015) in dealing with disaster in their region (Bier, 2017; Auzzir *et al.* 2018; Mechler and Bouwer, 2015).

Building a communication response plan to manage disaster has also been identified as lacking in several disaster risk regions in the Indian Himalayas. A typical example can be cited using the Uttarakhand (Shekhar, 2015), the region was severely hit by disaster due to poor communication structure in place to manage disaster (Tint *et al.* 2016). It is therefore imperative that regions within the Indian Himalayas adopt a well structured and functional communication action plan (Bunker *et al.* 2015), most especially for those individuals residing in a poorly constructed building (Rumbach and Follingstad, 2019). Incorporating this approach within the region will enable residents to prepare ahead and take prompt and decisive actions to reduce the impact of eventual loss.

Also, it is also important for communities in risk-prone regions of the Himalayas to strengthen their local capabilities to prepare and respond to a disaster. Developing and incorporating communal policies would form a long-term solution (Johnson *et al.* 2018) rather than wait for government intervention schemes which may delay or in most cases are not forthcoming (Matyas and Pelling, 2015).

IMPACT REDUCTION IN OTHER REGIONS

Several underpinning issues have slowed down the disaster recovery process especially in high-risk zones of the Indian Himalayas over the past decade. The proposed Tourism development master plan 2007 to 2022 which was meant to address issues on sustainable housing development failed as it didn't have a sustainable disaster driven approach in place (Mishra *et al.* 2019).

Intervention from global financial institutions like the World bank has extensively funded the re-construction of extremely damaged houses within the disaster-prone areas of the Himalayan region making residents safe and prepared to respond to emergencies (Tambe *et al.* 2018). Developing strategies and approaches for mitigating has been argued to be insufficient in addressing the need of those who survive from disaster cases (Suppasri *et al.* 2015). Stephan

et al. (2017) believe that not considering the living conditions, wants and choices would further subject them to even greater hardship.

The effective implementation of post-disaster recovery plans poses major challenges even among developed-world nations (Yoon et al. 2016). A review on countries such as Australia and China and their approaches in dealing with cases of disaster shows the deficiencies in planning and preparedness in responding to disaster within their counties (Cornia et al. 2016). Research has attributed these lapses to the government or stakeholder's not been entirely familiar with the disaster-prone zone in their countries or regions (Pant and Cha, 2019). Furthermore, lack of engagement and improper communication channels between the stakeholders and residential building construction firms has resulted in an increased setback to the fight against disaster in these developed countries (Townshend et al. 2015).

CONCLUSION

Predicting accurately the extent of damage that could result from a possible case of natural disasters is one phenomenon that continued to receive extensive research even in contemporary times. This unpredictable nature of disaster cases has resulted in communities located in high-risk disaster-prone regions of the world to become increasingly susceptible to disaster. Hence, in responding to known natural hazards within a region, communities must adopt measures for disaster management. Experiential studies and recovery approaches in response to disaster allows stakeholders that are exposed to natural disaster reflect on past catastrophises and build up resilient frameworks that are geared towards disaster management. This research piece has attempted to address the issue of disaster management in the light of relevant academic journals and previous research by other authors to proffer a model for disaster management within the Indian Himalayas region.

Recognised as having some of the world's most under-developed countries of the world and recording some of the highest rates of incidence of earthquakes around the world, the Indian Himalayan region is characterised by poorly constructed residential buildings which have resulted in several reported casualties. Failure to adopt sustainable disaster management approaches and the use of building material that cannot withstand earthquakes has further resulted in the region been affected negatively by disaster over the past decades. Although authorities within the region conduct routine sensitisations through the media and other communication channels, residents continue still reside in their partially delapidated buildings.

The incorporation of disaster management frameworks and models such as community resilience, communicating as a communal unit and communal problem-solving approach are some of the measures the stakeholders (residents, government and non-governmental organisations) in the Indian Himalayan region may seek to address disaster events. Furthermore, a review of the approaches adopted in developed countries in coping with disaster especially with respect to the standard and quality of building constructions in disaster-prone regions is also very important from a research context. Countries such as Korea Republic, Canada have to a large extent been able to develop a well-structured policy that enables them to sanction the use of sub-standard building materials for residential houses in disaster regions. Government interventions and shared communal resilient measures within these developed world countries have also allowed them to remain functional even in the aftermath of a calamity.

Finally, a proactive move for swift and effective disaster management approach within disaster-prone regions in the Indian Himalayas is imperative and residents within these high-risk

communities must work together to ensure that they build sustainable resilience to disaster within their region.

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